Space Weather Technical Forecast

Issued on Thursday, 28 July 2022 at 01:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1/Minor Storm intervals day 3 (30th)

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with an impulsive C3 flare peaking at 27/1056 UTC, originating from the new region in the southeast. There are six sunspot regions on the visible disc, two of which are currently unnumbered. However they are all small and simple, with no obvious signs of growth or slightly decaying.

The small filament near AR3062 is showing signs of instability. No lift-off has been observed at present however it is being monitored, particularly as it transits across the southeast quadrant. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR and ACE at L1, followed a declining trend over the last 25 hours, reducing erratically from 500 to around 400km/s as the influence of any recent weak coronal hole or transient enhancement decayed. Density was around average. The interplanetary magnetic field (IMF), Bt, was largely weak but increased at the end of the period, peaking at 9nT, with the north-south component, Bz, increased its fluctuations, ranging from 7nT to -8nT. The Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet with a provisional Unsettled interval (kp3) between 27/2100-2400. UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES16 was at Background levels. The High energy electron flux (greater than 2MeV) varied between Moderate and High levels, with a peak of 1280pfu observed at 27/1700UTC. Electron fluence showed a slight decline whilst remaining below the Active threshold, with an observed fluence of 2.97e7 integrated pfu recorded at 28/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain Very Low to Low with only a slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: No CMEs have been assessed as Earth-directed. Solar winds are expected to be slow-ambient initially, before the arrival of the fast wind of CH04 in the early UTC hours of day 3 (30th), enhancing solar winds to around 500km/s on days 3 and 4. Geomagnetic activity is forecast to be mainly Quiet with a chance of Unsettled intervals, then to become Unsettled and Active with an outside chance of G1/Minor storms on day 3 (30th).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at Background levels. The high energy electron flux (greater than 2 MeV) is expected to remain mostly at Background and Moderate levels, with the corresponding 24 hour fluence remaining below the Active threshold (1e8 integrated pfu).

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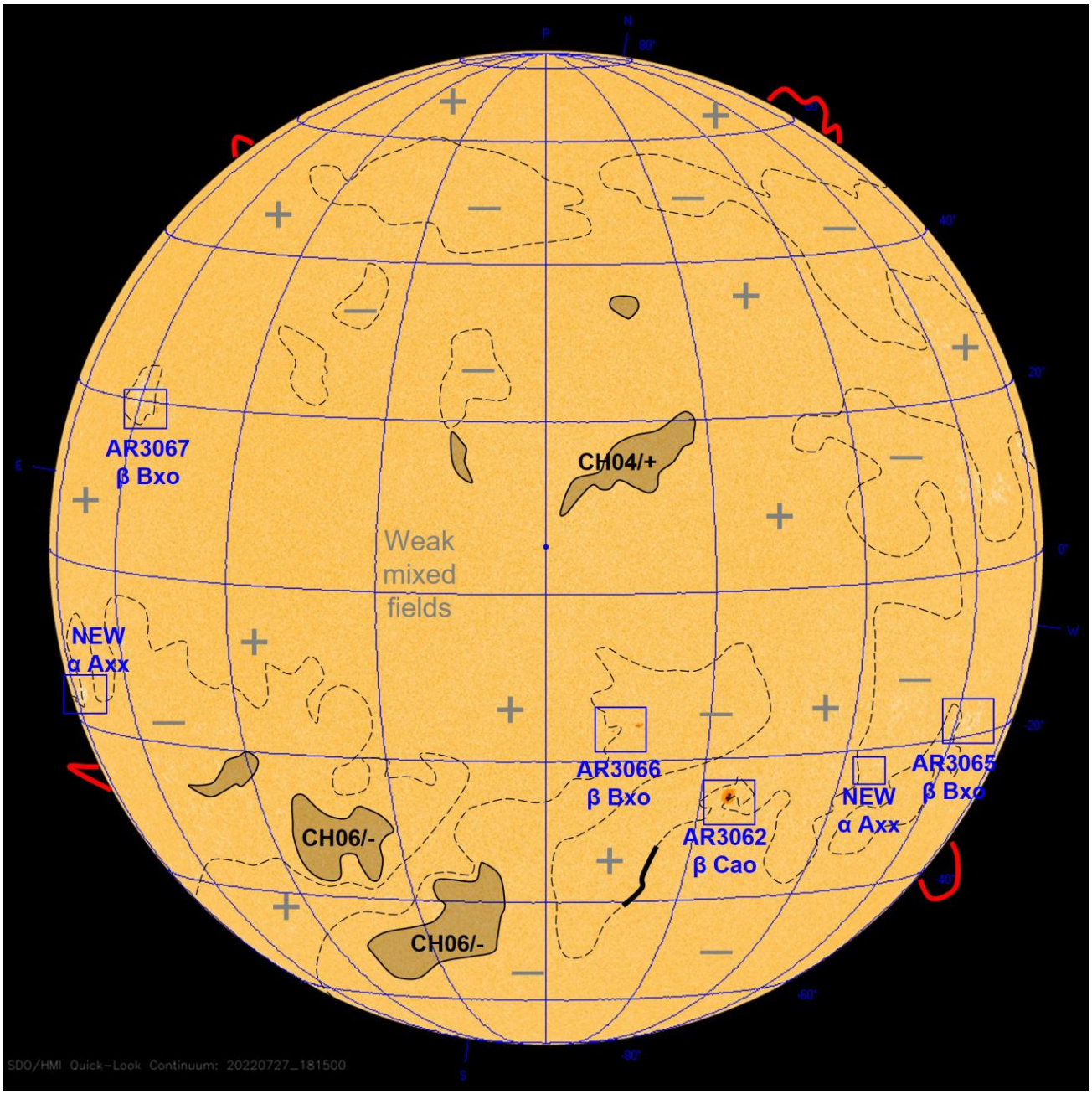
Figure 1. Solar Analysis Valid 27/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

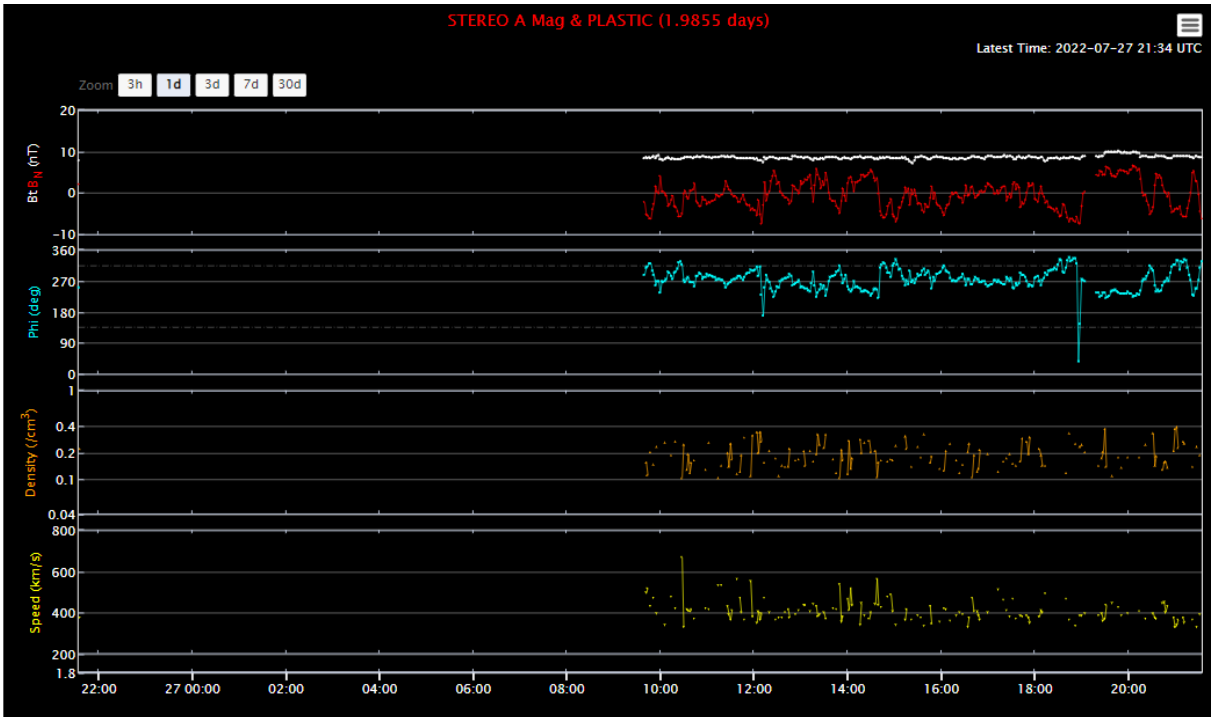
No CMEs have been assessed as Earth-directed for this period.

Solar winds are currently at slow-ambient levels, with no significant enhancements expected in the next 24 hours. The next coronal hole worth of note is CH04/+. It is not a recurring feature so persistence cannot be relied upon, however data obtained from Stereo A Mag & Plastic does not indicate any particular enhancement yet, which would suggest an arrival of the associated fast speed stream at Earth in the early UTC hours of day 3 (30th) at best. Based on the coronal hole dimensions, estimated speeds would be around 500km/s. Enlil suggests a notable enhancement on the 28th, which is considered too soon.

Geomagnetic activity is forecast to be mainly Quiet with a chance of Unsettled intervals, then to become Unsettled and Active with an outside chance of G1/Minor storms on day 3 (30th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	30	5
Strong	G3	No	1	1	2	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Stereo A Mag & Plastic data showing a negative phi angle whereas CH04 is positive



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Radio Blackouts - X-Ray Flares:

Solar activity has been Low, with an impulsive C3 flare peaking at 27/1056 UTC, originating from the new region in the southeast. There are six sunspot regions on the visible disc, two of which are currently unnumbered. However they are all small and simple, with no obvious signs of growth or slightly decaying. The new region in the southwest has persisted as a small Axx/Alpha spot, the other new region in the southeast disc is a simple bipolar Bxo/Beta.

Far-sided products give a potential for further regions to rotate onto the disc over coming day or two, however confidence is low regarding the size and activity associated with the regions. Low to Very Low activity is expected to continue through the period, with only a very slight chance of rising to Moderate due to any M-class flares (R1 Radio Blackouts).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Latest GOES X-ray flare activity

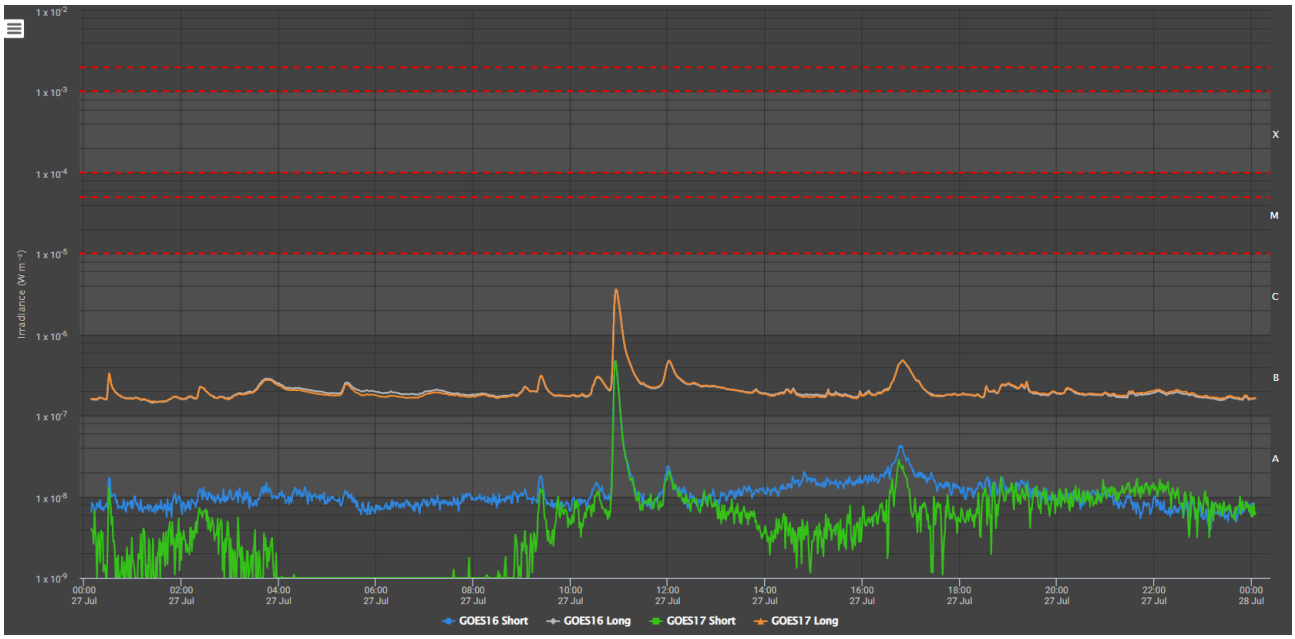

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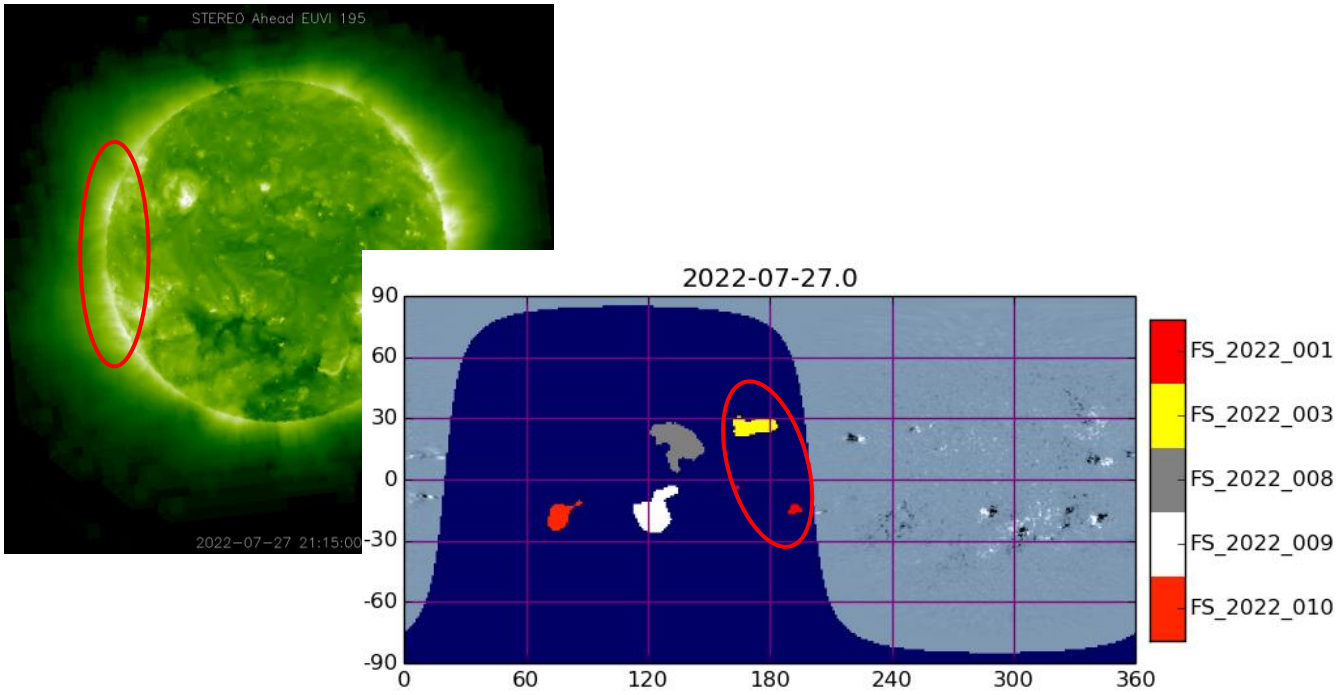
Figure 4: Latest EUVI 195 showing bright flux regions (left) and Stanford Seismic Monitor of the Sun's Far Hemisphere (right) which identifies "strong active regions"



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels and is currently expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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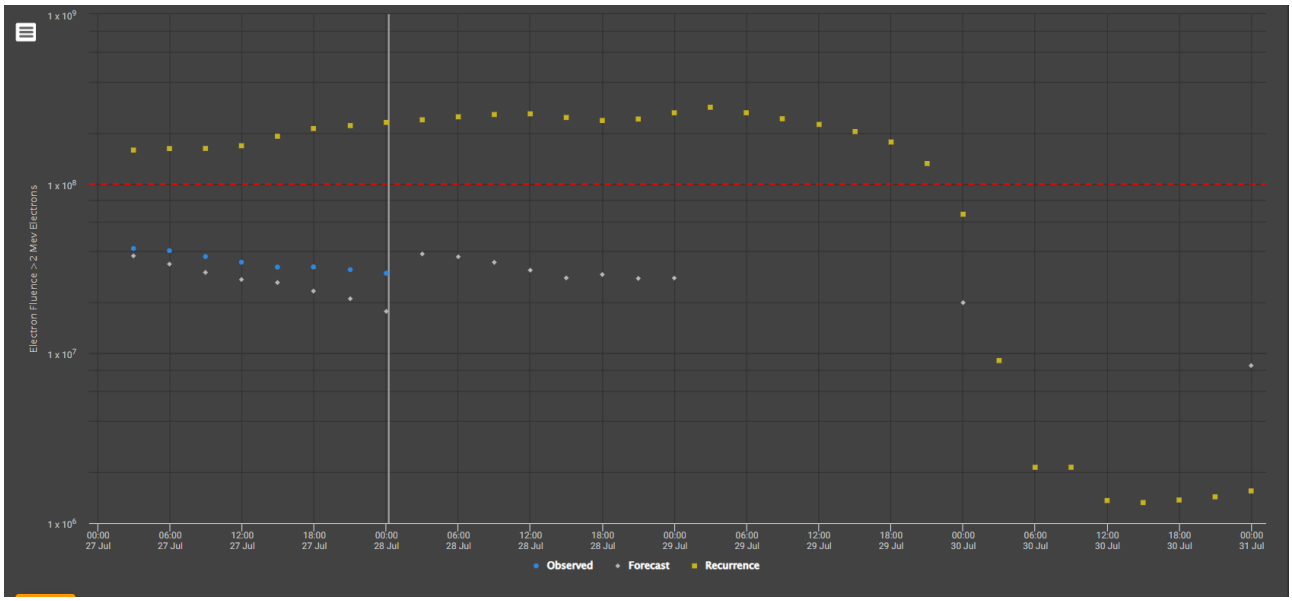
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2MeV) is expected to continue fluctuating between background and moderate levels on days 1 & 2, perhaps briefly exceeding high during the diurnal peak (as it did over the last few days). However the arrival of the high speed stream from CH04 on day 3 will most likely see electron counts fall to background. Flux levels may increase on day 4, but data obtained from the previous rotation indicate that the rise was slow and only exceeded high levels after several days, way beyond this forecast period.

The corresponding 24-hour fluence is expected to remain below the Active threshold through the period, perhaps exhibiting a slight rising trend at the end of this period. This is supported by the REFM output.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: Latest REFM output



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